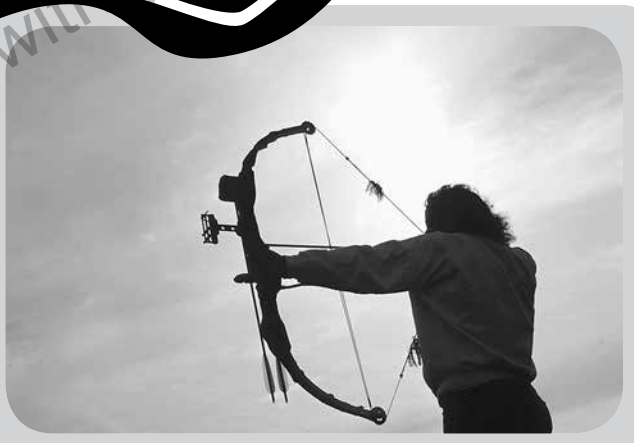


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ON  
SCIENCE**

# Forms of Energy

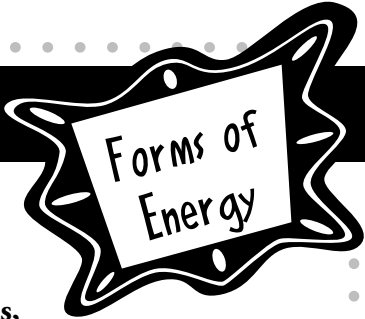
Basic Level



Physical Science  
Simple and Complex Machines

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## Forms of Energy

### Scientific Inquiry

**Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.**

Develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.

Design scientific investigations (e.g., observing, describing, and comparing; collecting samples; seeking more information, conducting a controlled experiment; discovering new objects or phenomena; making models)

Carry out their research proposals, recording observations and measurements (e.g., lab notes, audiotape, computer disk, videotape) to help assess the explanation.

Conduct a scientific investigation.

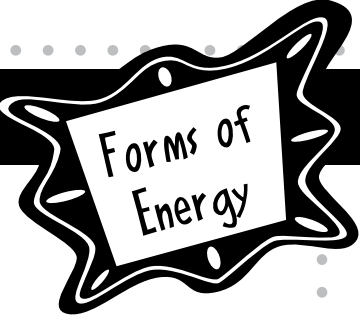
Collect quantitative and qualitative data.

### Physical Science

**Energy exists in many forms, and when these forms change energy is conserved.**

Different forms of energy include heat, light, electrical, mechanical, sound, nuclear, and chemical. Energy is transformed in many ways.

Energy can be considered to be kinetic energy, which is the energy of motion, or potential energy, which depends on relative position.



## Forms of Energy

### English Language Arts

The following is a selective listing of the competencies and indicators addressed in this book.

#### Word Recognition

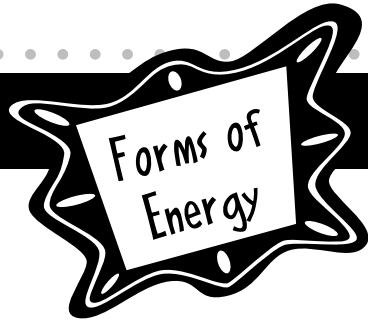
- Use word recognition skills and strategies quickly, accurately, and automatically when decoding unfamiliar words

#### Background Knowledge and Vocabulary Development

- Use self-monitoring strategies to identify specific vocabulary difficulties that disrupt comprehension, and employ an efficient course of action, such as using a known word base or a resource such as a glossary to resolve the difficulty

#### Comprehension Strategies

- Use a variety of strategies (e.g., summarizing, forming questions, visualizing, and making connections) to support understanding of texts read



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## How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

- Underline main ideas in paragraphs.
- Circle details that support the main ideas.
- Write down questions as they read.
- Circle key words as well as unfamiliar words.

## Printing Instructions

**Student Book:** print pages 5–30

**Assessments:** print pages 31–34

**Answer Key:** print pages 35–38

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SCIENCE**

# Forms of Energy

**How does energy play a role in our lives?**

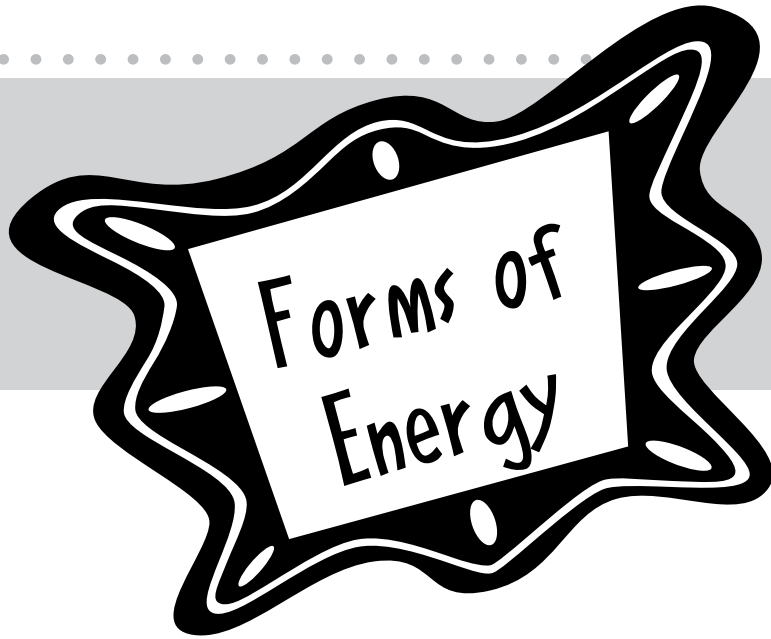
Everything you do requires energy. It takes energy to ride a bicycle. It takes energy to heat your home. It takes energy to power your computer.

So what is energy? Where does it come from? Are there different types of energy?

Read on to learn how you can identify energy and track how it can be changed from one form to another.



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# Build Background

## Define

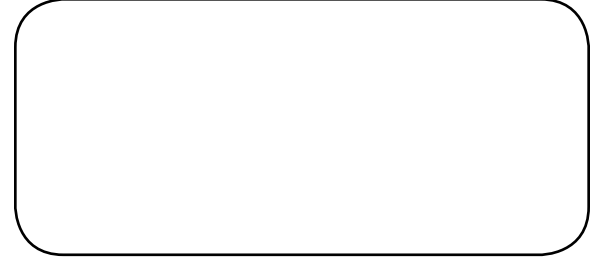
Your friend's little sister wants to know what the word energy means. How would you describe it in a way she would understand?

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## Brainstorm

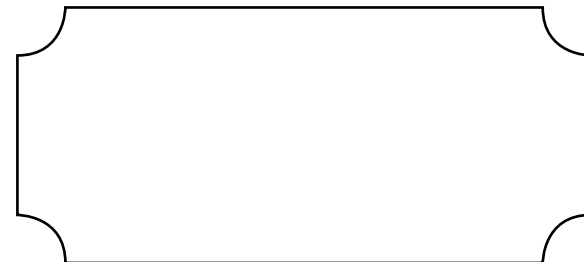
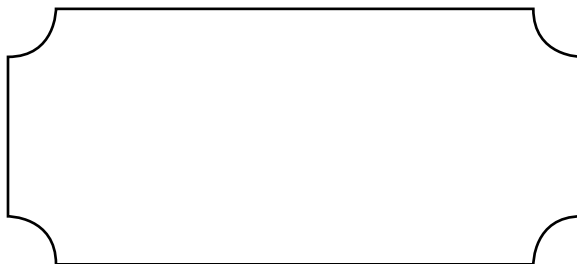
Mind mapping is a way of putting your thoughts into pictures and symbols. Think about anything that has to do with energy. A lit match is an example. It provides heat and light energy. Think of other symbols or pictures to add to this mind map. Write a label under each one. Remember, there are no wrong answers. Any connection your brain makes to energy is worth mapping out!



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Light and heat energy

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# Key Vocabulary

## Rate Your Knowledge

The words listed below have to do with types of energy. Each word is important, but some of them may be new to you. Rate your knowledge of each one by checking the appropriate column. Give the definition if you know the word. After completing this book, come back to this page and write the definitions of words you did not know.

	I don't know it.	I've seen it, but I'm not sure what it means.	I know it well, it means...
potential			
kinetic			
particle			
atom			
mechanical			
thermal			
radiant			
nuclear			
chemical			
acoustic			



## Key Vocabulary

### Context Clues

Below are several sentences that use some of the words you read on page 9. Read each sentence. Each sentence contains clues about what the underlined word means from its context. From the context clues in the sentence, write a definition on the lines below. Then go back to the chart on page 9 and add something to the “I’ve seen it” or “I know it” columns.

1. I prefer to use a mechanical pencil rather than a regular one, because the mechanical pencil doesn't need sharpening.

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2. He wasn't crying, he just had a particle of dust in his eye.

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3. Joseph could see frost on his window, so he put on his thermal underwear under his school clothes.

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4. Because Sarah wasn't trying very hard in school, her parents told her she “wasn't living up to her potential.”

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## Key Concepts

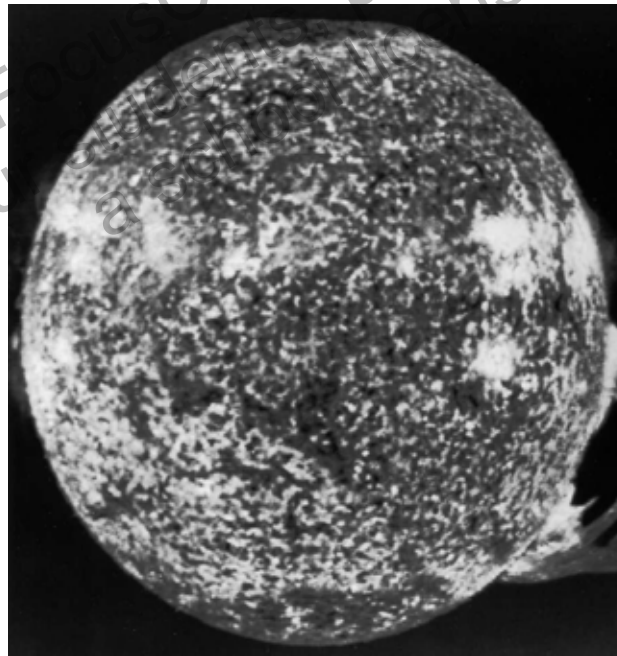
### What Is Energy?

What do you mean when you say you have a lot of energy? Lots of energy might allow you to run extra hard in a soccer game. Or, it might allow you to dance for hours.

So what is energy? Energy is the strength that allows you to do activity or work. Work is the transfer of energy. Work always requires energy. Some energy is used to create action. Other energy is stored for later use.

Energy comes in many forms. But all energy starts with the sun. Energy from the sun arrives as light and heat. It warms us here on Earth. Plants use the sun's energy to make food. We eat some plants and use the energy plants get from the sun to live and grow.

There are many other forms of energy. Read on to learn more about them.



*The sun is the source of all energy on Earth.*

### ACTIVE READER

**1 Relate** *When do you feel most energetic? Why do you think this is?*

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# Chapter 1 Kinetic and Potential Energy

## FOCUS

In this section, you will be reading about two types of energy; kinetic energy and potential energy. The underlined sentences show how kinetic energy is different from potential energy.

## Two Types of Energy

### Kinetic Energy

The word kinetic means “moving.” **Kinetic energy** is the energy of motion. For something to have kinetic energy, it has to have mass and it has to be moving.

The bigger and faster something is, the more kinetic energy it has. If a train were coming toward you on a track at 30 miles per hour, you’d jump off the track. That train has a lot of energy and would hurt you. But something light and slow, like a butterfly, doesn’t have the energy to hurt you. In fact, you would barely feel it if it hit you!

### Potential Energy

An object with **potential energy** doesn’t have to be moving. Potential energy is stored energy. It can’t do work. It is ready to do work, but it has to be changed to another kind of energy to actually do work.



*A bowling ball traveling down the lane has kinetic energy because it is moving.*

## ACTIVE READER

**1 Extend** *If you are interested in a career in sports, you may choose to study the field of kinesiology. Using what you know about the word kinetic, what might you study in the field of kinesiology?*

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A match is an example of potential energy. The chemicals in the match head contain potential energy. However, the chemicals can't burn without first striking the match.

Potential energy can be stored in the **position** of an object. For example, you are probably sitting at a desk right now. Look at something near the edge of your desk such as a pencil or pen. That pencil or pen has potential energy.

If you push that pencil or pen off the desk, the potential energy will be converted to kinetic energy as it falls to the floor. When it is falling, it has kinetic energy.

Any object that has been lifted away from the ground has gravitational potential energy. This is because gravity can do work on it. The higher it is, the more gravitational potential energy it has.

Another example of potential energy is a stretched bowstring. Even if the bow string is not moving, it has potential energy. Energy has been stored by stretching it. If you release it, the arrow connected to the bowstring will fly through the air.



*The archer has stored energy in the position of the bowstring by drawing it back. Until the archer releases the bowstring, the arrow won't move.*



*This match has converted potential energy stored in the match head to kinetic energy in the flame.*

**ACTIVE READER**

**1 Recall** *What can kinetic energy do that potential energy cannot?*

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**FOCUS** QUESTIONS

- Two identical cars are driving on the highway. One is driving at 50 mph and one is driving at 65 mph.

Identify which car has more kinetic energy. Explain how you know.

Identify: \_\_\_\_\_

Explain: \_\_\_\_\_

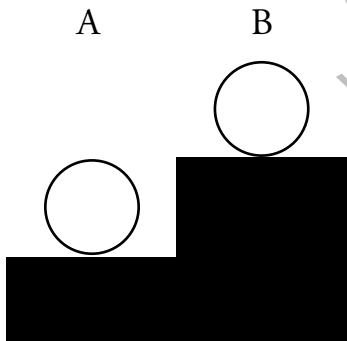
\_\_\_\_\_

- Identify two ways that potential energy differs from kinetic energy.

Identify: \_\_\_\_\_

Identify: \_\_\_\_\_

- In this diagram, identify which ball has more potential energy. Explain why.



Identify: \_\_\_\_\_

Explain: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**ACTIVE READER**

**1 Predict** Which do you think stores more energy, an ice cream cone or a banana?

\_\_\_\_\_

**2 Explain** Explain your choice from above, using your knowledge of food and energy.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Good to Know**

The oil we use in our cars stores energy. When oil is made into gasoline, our cars are able to use the stored energy in the oil. The potential energy in the oil is converted into kinetic energy when the gasoline is burned. Then the car can move.



**Identify Kinetic and Potential Energy** For each of the following objects, fill in whether you think the object has potential energy, kinetic energy, or both. Then provide a brief explanation for your choice.

Object	Kinetic energy, potential energy, or both?	How do you know?
A ball rolling along the ground		
A muffin		
A plane flying through the air		
A car driving on the road		
A compressed spring		
The gasoline tank in a moving car		



## Measure the Effect of Height on Energy

The position of an object can store energy. In this experiment, you will test how the height of a ball affects its energy as it makes an impact on the flour below.

### Background

Potential energy can be stored in an object's position. Any object that can be acted on by gravity has gravitational potential energy. We should expect that the position of the object (how far away it is from the floor) should have an effect on its energy. Kinetic energy is the energy of motion. It depends on an object's mass and speed. The energy can be measured by how much flour is displaced by the falling ball. This shows how much work the ball is doing on the flour.

### Objective

To determine the effect of the ball's height on its energy as it hits the flour.

### Hypothesis

Write out what you think will happen and why.

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### Materials

- ball (golf ball works well)
- pan of flour, at least 2–3 inches deep
- meter stick

### Procedure

1. Using the meter stick, measure 10 cm above the surface of the flour.
2. Drop the ball from this first height.
3. Measure the diameter of the crater formed in the flour. Record this in your data table on page 17.
4. Smooth the flour.
5. Repeat steps 2–4 twice more, recording your data in the data table each time.
6. Complete your trials for the other heights (50 cm, 100 cm).
7. Clean up your lab station.





## Measure the Effect of Height on Energy

(continued)

Height of ball drop (cm)	Diameter of crater formed (cm)			Average diameter (cm)
	Trial 1	Trial 2	Trial 3	
10 cm				
50 cm				
100 cm				

### Analysis

1. Identify the variables you are testing in this experiment:

a. Independent variable (what changes): \_\_\_\_\_

b. Dependent variable (what is affected by change): \_\_\_\_\_

2. When you were holding the ball above the flour, what kind of energy did it have? Explain.

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## Measure the Effect of Height on Energy

(continued)

3. In the moment before the ball hit the flour to create the crater, what kind of energy did it have? Explain.

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4. Using your data as evidence, write a statement summarizing the effect of height on the energy of a falling object.

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5. Why did you perform each trial three times?

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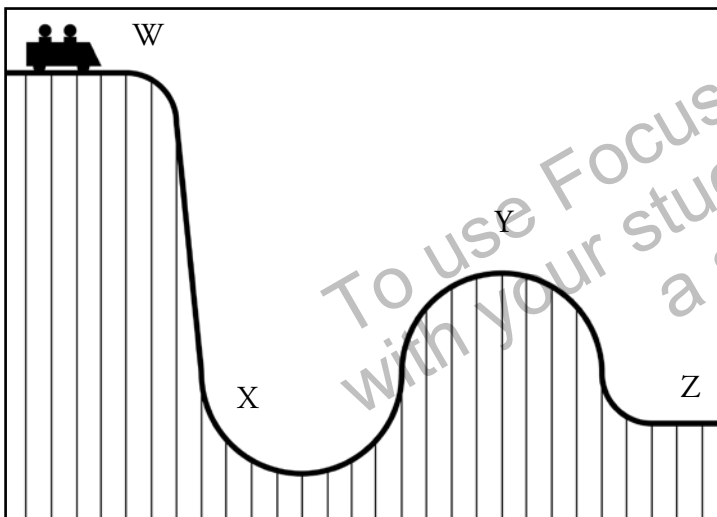
## Stop and Think

This page will help you summarize what you have read so far.

1. At the moment a plane touches the ground of the runway, it travels at about 300 mph. As it travels along the runway at this speed, what kind of energy does the plane have?

- |                    |                                  |
|--------------------|----------------------------------|
| (1) kinetic energy | (3) potential energy             |
| (2) radiant energy | (4) potential and kinetic energy |

Base your answer to question 2 on the diagram below and on your knowledge of science.



2. Which sentence describes the roller coaster car at point X?

- (1) The car has only potential energy.
- (2) The car has some potential and some kinetic energy.
- (3) The car has more potential energy than kinetic energy.
- (4) The car has more kinetic energy than potential energy.

Dear Ms. Understanding,

So, I get that potential energy is stored energy, and kinetic energy is the energy of motion. But here's a less clear situation.

I just ate a big lunch and I'm running the mile in PE. Aside from having a giant side-stitch, what kind of energy do I have?



*Worried in Wyoming County*

Dear Worried,

You have both! The fuel your body is using is potential energy.

Your body also stores lots of energy in the form of fat that you can use. But when you are running, you also have kinetic energy because your body is moving.



*Ms. Understanding*

# Chapter 1 Energy Types

## FOCUS

In this section you will be reading about different types of energy. As you read, think about which are potential energy, which are kinetic energy, and which are both.

## Sources of Energy

You have learned that light energy from the sun helps plants grow. You may have heard people talking about other forms of energy such as wind energy or nuclear energy. There are many different forms of energy, and it comes from many different sources.

## Electrical Energy

Things that plug into a wall socket or use a battery rely on electrical energy. Think about an MP3 player or a cell phone. Both rely on electrical energy. You plug your device into an electric outlet to get electricity to make it work.

Both also have batteries. When you charge the battery, you are storing electrical energy for later use. **Charge** is energy stored in a battery.



Batteries store electrical energy for future use.

## ACTIVE READER

**1 Extend** *Electrical energy use is on the rise. Name three or more of the objects you use on a daily basis that require electricity.*

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**2 Weigh In** *Do you think our increased use of electrical devices such as computers, MP3 players, and cell phones has improved life or made it more distracting? Why?*

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## Mechanical Energy

Mechanical energy causes one thing to move another. For example, wind creates mechanical energy in the moving of wind turbine blades. A car engine creates mechanical energy in the turning of the car's wheels. Mechanical energy always involves motion.

## Chemical Energy

In Chapter 1, you learned about chemical energy stored as potential energy in a match. Chemical energy is also in the food we eat. When we think about “fuel,” whether it's food for our bodies, gasoline for our cars, or coal for a coal plant, we're usually talking about chemical energy.

For example, your muscles convert chemical energy into mechanical energy to move your legs and arms. Gasoline by itself can't power a car. However, a car's engine can burn the gasoline, converting chemical energy into mechanical energy which turns the car's wheels.



*Wind turbines are a source of renewable energy. They capture mechanical energy from the wind and convert it to electrical energy.*

### ACTIVE READER

**1 Interview** Interview a parent or friend about his or her energy use. Ask where he or she believes most of our energy should come from and why. Possible energy sources are nuclear energy, coal or gas (chemical), wind or water (mechanical).

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## Thermal Energy

Thermal energy is heat. Thermal energy is the movement of **atoms**. Atoms are the tiny particles that make up matter. Atoms are constantly moving. They don't all move the same way, however. The atoms in a solid move much less than the atoms in a gas. The more the atoms move, the more thermal energy the object has. The amount of thermal energy something has is measured by temperature.

## Nuclear Energy

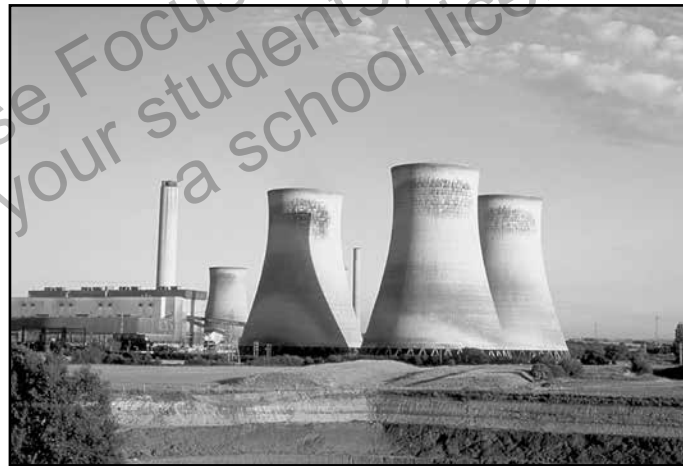
Nuclear energy is stored in the bonds of an atom. The bonds within the center, or **nucleus**, of an atom are very strong. Breaking these bonds by splitting apart the nucleus releases lots of energy. In nuclear power plants, the released energy is converted to electricity.

## Acoustic Energy

Acoustic energy is sound. It travels in waves. Waves cause things to vibrate. When someone plays a guitar, the strings vibrate producing waves. Acoustic energy travels as a wave. It makes air particles vibrate. The waves travel to your ear, causing your eardrum to vibrate. That's how you hear the sound of the guitar!

## Electromagnetic Energy

Electromagnetic energy is the energy of light. It is sometimes called radiant energy. The major source of light energy is the sun. Without this energy traveling to us from the sun, our planet would be lifeless.



*At the Perry Nuclear Power Plant, nuclear energy is converted to thermal energy, which is then converted to electrical energy.*

### ACTIVE READER

**1 Weigh in** Nuclear energy can be a clean, renewable source of power for people to use. However, it can also be dangerous to produce. Based on what you know, do you think more nuclear power plants should be built? Why or why not?

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**2 Connect** Acoustic energy travels in waves, moving anything it travels through. Would this be more of a kinetic or a potential form of energy?

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Like acoustic energy, electromagnetic energy travels in waves. These waves cause the colors of the rainbow. They also cause UV radiation that can give you a sunburn.

Plants are among the only living things that can convert this radiant energy directly into chemical energy. This is why all food chains begin with plants.



*Plants are the only living things that can convert electromagnetic energy into chemical energy. They make life possible for the rest of us!*

**FOCUS** QUESTIONS

1. Is electrical energy a form of kinetic energy, potential energy, or both? Explain.

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2. Is mechanical energy a form of kinetic energy, potential energy, or both? Explain.

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3. Is chemical energy a form of kinetic energy, potential energy, or both? Explain.

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**Good to Know**

You might also know that nuclear energy can be used to create dangerous weapons. Uranium is the atom most often split to create nuclear energy, which is why international groups often track different countries' use of uranium.



Where does the energy in your house come from? Look up the power provider in your area. The provider's Web site should give you an idea whether coal, nuclear, renewable sources (wind and water) or some combination create electricity for local homes. Are there "greener," more renewable sources of power for your home that you can use? What are they?

## Stop and Think

This page will help you summarize what you have read so far.

## Tip:

Consider all of the answer choices before you choose the best one. Think about how each answer choice differs from the others.

**1. Hydroelectric power is a clean source of renewable energy. The energy created as a river flows through a dam is converted to electricity. Hydroelectric power is an example of**

- (1) kinetic energy
- (2) potential energy
- (3) chemical energy
- (4) electrical energy

**2. The flight of an airplane, from takeoff to landing, involves many different forms of energy. An example of chemical energy is**

- (1) the energy of the plane's forward motion
- (2) the storage and use of the energy in the fuel
- (3) the heat energy generated by the plane's motors
- (4) the energy stored in the plane's position in the sky

**3. Plants take in energy from the sun and turn it into food. Which statement best describes this energy transformation?**

- (1) acoustic energy into kinetic energy
- (2) electrical energy into radiant energy
- (3) potential energy into thermal energy
- (4) electromagnetic energy into chemical energy

**Dear Ms. Understanding,**

Wait—so kinetic energy is the energy of motion. But then mechanical energy is about movement as well. What IS the real difference?



*Concerned in Canandaigua*

**Dear Concerned,**

You've brought up a great question. You can think of mechanical energy as due to either the movement of an object (kinetic) or its position (potential). So, a bowling ball in a bowler's hands has potential energy and then kinetic energy as it rolls down the lane toward the pins. When it strikes the pins, its mechanical energy is transferred to the pins, and they go flying.



*Ms. Understanding*



# Chapter 3 Energy Conversions

## FOCUS

In this section you will read about how energy can be converted to different forms. Use this as a way to review the forms of energy you learned in the last section. If you see a type of energy that you can't quite remember, go back and look it up.

## Energy Changes

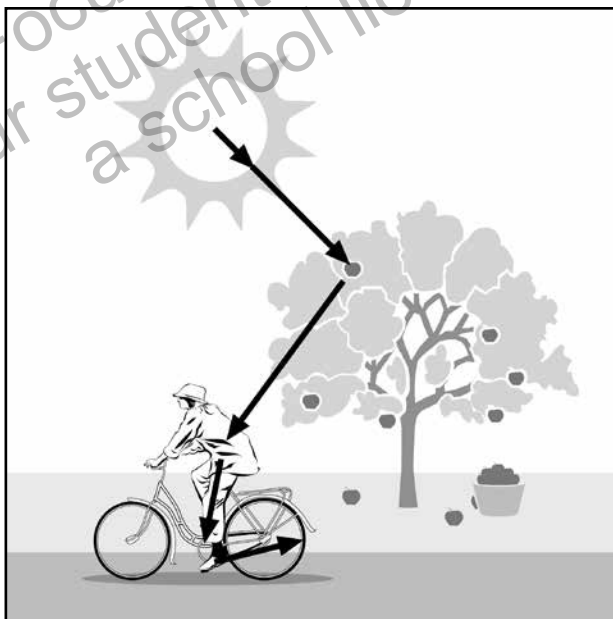
Any form of energy can be changed to another form. As you know, potential energy is stored, and needs to be converted to kinetic energy to do work. But all the different forms of energy can be converted to other forms, as well.

For example, the radiant energy of the sun is converted to chemical energy when plants make their own food. When you eat that plant, the chemical energy from the plant is converted to mechanical energy that powers your legs to pedal a bike.

The potential energy stored in your muscles is converted into the kinetic energy of the moving bike. If you pedal up a hill and slowly come to a stop, the kinetic energy of the bike is converted back into potential energy.

You can think of energy conversions like a long chain. One type of energy is converted to another, and another, and another. Like a food chain, most energy chains can be traced back to the sun. That is where chemical reactions produce radiant energy.

*You can think of energy conversions as a kind of chain. Follow the energy chain in this diagram.*



## ACTIVE READER

**1 Connect** Create a chain of at least four energy conversions that begin with the chemical energy of your breakfast. Draw your chain below.

Many other conversions are also possible. However, no energy is ever lost during these conversions. All of the energy involved in a change appears in some form after the change is completed.

The Law of Conservation of Energy states that energy cannot be created or destroyed. It can only change its form. In fact, the total amount of matter and energy available in the universe doesn't change. There will never be any more or any less.

**FOCUS** QUESTIONS

1. What kind of energy can radiant energy be converted to?

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2. The sound of a siren travels through the air; when it strikes your eardrum, your eardrum vibrates and you hear sound. What two forms of energy are involved in this conversion?

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**ACTIVE READER**

**1 Recall** Look back at the illustration on page 25.

Identify the relationship and type of energy conversion that occurs at each step in the chain.

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## Discover Energy Conversions

Energy is being converted around you (and by you) all the time! In this activity, you will be identifying some of these transformations. For example, when you hit your pencil against a desk, it makes a noise—mechanical energy is converted to acoustic energy.

### Observe

1. Rub your hands together vigorously for 30 seconds. Describe what you observe happening and what you feel.

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### Explain

2. What simple energy conversion is taking place that explains what you feel?

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### Extend

3. When it's cold, your hands need help getting warm. Some people use hand-warmers that contain chemicals, which when mixed generate heat that warms your hands. What kind of energy conversion is happening?

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### Connect

4. Describe three energy conversions that you can observe at school or at home. Make sure you describe what kind of energy is being transformed into each new form.

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## Stop and Think

This page will help you summarize what you have read so far.

**Tip:**  
Look back through the chapter to find key words in the answer choices. Reread the sentences that contain those words.

1. When the sun's light rays are focused through a magnifying glass onto something dry, like leaves, the leaves will start to burn. What kind of energy conversion is this?

- (1) electromagnetic to thermal  
 (2) chemical to electromagnetic  
 (3) nuclear to thermal  
 (4) electromagnetic to mechanical

Base your answers to questions 2 and 3 on the information below and on your knowledge of science.

In some nuclear submarines, a reactor splits atoms to generate heat used to create steam. This steam heat drives an electrical generator to create electricity, which is used to turn the driveshaft and propellers.

2. Draw an energy chain with arrows to show which kinds of energy are being converted at each step. Hint: there are four different types of energy involved.
3. Write a sentence explaining the energy conversion involved in the final step.

---

Dear Ms. Understanding,

So, I get that almost all of our energy here on Earth can eventually be traced back to the sun's radiant energy. But I learned that all energy comes from somewhere, so where does the sun's energy come from?



Careful in Carmel

Dear Careful,

What a great question! The radiant energy that reaches Earth comes from nuclear reactions between atoms in the sun's hot core. But that nuclear energy has to come from somewhere, right? Scientists believe an event called the Big Bang created all the energy and matter in our universe, in a fraction of a second, and it's this energy that is constantly converted. Exactly how the Big Bang worked, and what came before that, are not yet known. Perhaps you'll someday help to answer some of these questions!



Ms. Understanding

# Glossary

**atom** – a very tiny particle of matter

**charge** – energy stored chemically in a battery for conversion into electricity

**chemical bond** – a connection holding different atoms together

**chemical composition** – the chemicals that make up an object

**energy** – the ability to do work

**kinetic energy** – the energy of motion; something must have mass and be moving

**nucleus** – the center of an atom

particle – a tiny part of a whole

**pigment** – the natural coloring matter of an animal or plant

**position** – a place where something is located

**potential energy** – energy that is stored in an object's position or its chemical composition

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SCIENCE**

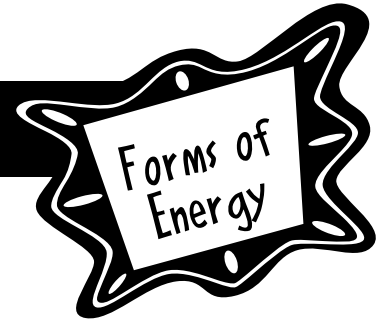
# Forms of Energy

Assessments

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# Check Understanding



In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

1. Which of the following sentences about potential energy is not true?

- (1) Potential energy can do work directly on an object.
- (2) Potential energy can be stored in the position of an object.
- (3) Potential energy can be converted to other forms of energy.
- (4) Potential energy can be stored in the chemical composition of an object.

2. Your car converts gasoline into the motion of the turning wheels so your car moves. What kind of energy conversion is this?

- (1) nuclear to mechanical
- (2) chemical to mechanical
- (3) mechanical to chemical
- (4) electromagnetic to mechanical

## Answer Document

1.    ①    ②    ③    ④  
2.    ①    ②    ③    ④

Record your answers in the space provided below each question.

Base your answers to questions 3 and 4 on the information below and on your knowledge of science.

A stove has a coil with electric current running through it. As the current passes through the coil, the coil both glows red and heats up.

3. Identify the first form of energy being used.

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4. Explain all the energy conversions that are occurring in this situation.

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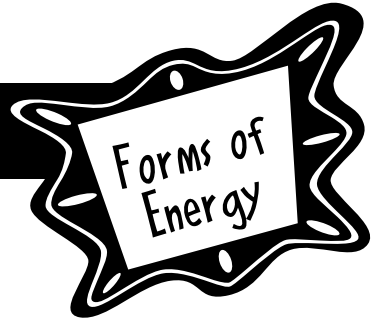
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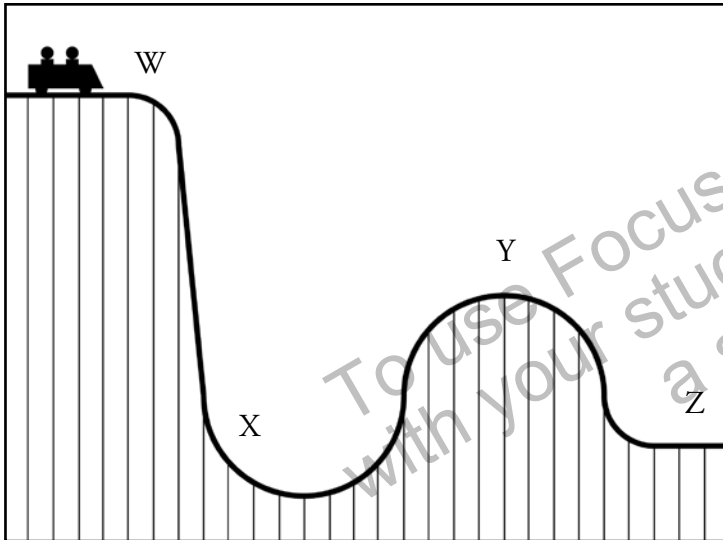
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# Check Understanding



In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

Base your answers to questions 5 and 6 on the diagram below and on your knowledge of science.



5. At which point does the car have the most potential energy?
  - (1) point W
  - (2) point X
  - (3) point Y
  - (4) point Z
  
6. Assume that the car is moving at points X, Y and Z. The BEST way to describe the energy of the car as it passes point Y is that the car has what kind of energy?
  - (1) kinetic energy
  - (2) potential energy
  - (3) mechanical energy
  - (4) potential and kinetic energy

Answer Document				
1.	①	②	③	④
2.	①	②	③	④

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ON  
SCIENCE**

# Forms of Energy

**Answer Key**

# Answer Key

## Pages 8: Starting Points:

### Build Background

**Define:** Answers will vary, depending on students' prior knowledge.

**Brainstorm:** Answers will vary.

## Pages 9 and 10: Starting Points:

**Key Vocabulary:** Answers will vary.

Page 11: Starting Points: Key Concepts

**Active Reader:** Answers will vary, but students should identify when they feel most active.

## Page 12: Chapter One

**Active Reader:** Answers will vary, but students should connect their understanding of the term kinetic. Kinesiology is the study of human motion.

## Page 13: Chapter One

**Active Reader:** Kinetic energy can do work directly, potential energy cannot.

## Page 14: Chapter One

**Active Reader:** 1. an ice cream cone, 2. Ice cream cone has more energy because it stores more calories.

**Focus Questions:** 1. The car driving 65 mph has more kinetic energy; since the masses are the same, the faster car has more kinetic energy., 2. Potential energy differs from kinetic energy in that potential energy cannot do work on objects directly; it has to be put in or stored somehow. Potential energy is stored in position and chemical

composition., 3. Ball B has more potential energy because it is higher and so has more gravitational potential energy.

## Page 15: Hands on Science: Identify Kinetic and Potential Energy:

Object	Kinetic, Potential, or Both?
A ball rolling along the ground	kinetic
A muffin	potential
A plane flying through the air	both
A car driving on the road	kinetic
A compressed spring	potential
The gasoline tank in a moving car	both

## Pages 16-18: Hands on Science: Measure the Effect of Height on Energy

**Hypothesis:** answers will vary

**Analysis:** 1. a. independent variable: height of drop. b. dependent variable: energy of impact, measured by diameter of crater, 2. Potential energy (gravitational), because the ball is held up and not moving., 3. Kinetic energy, because the ball is moving and is (almost) at a height of zero., 4.

Will vary according to data; most students should find that the height of the drop increases the energy of the ball as measured by the diameter of the crater., 5. Each trial was performed three times so that students could determine an average diameter.

## Page 19: Stop and Think

1. (1), 2. (2)

## Page 20: Chapter Two

**Active Reader:** 1. Answers will vary, but students should name three or more objects that use electricity., 2. Answers will vary, but students should offer an opinion as to whether electrical devices have improved life or not.

## Page 21: Chapter Two

**Active Reader:** 1. Answers will vary.

## Page 22: Chapter Two

**Active Reader:** 1. Answers will vary depending on what students know about nuclear power production., 2. Kinetic, since the waves of acoustic energy move whatever they travel through.

# Answer Key

## Page 23: Chapter Two

**Focus Questions:** 1. Both: Electrical energy is stored as potential energy in the charge separation, but used as kinetic energy in the flow of charge as current., 2. Kinetic: Mechanical energy is defined as movement-based., 3. Potential: Chemical energy is energy stored in bonds. It has the potential to do work when the bonds are broken, but the storage itself doesn't do work.

## Page 24: Stop and Think

1. (1), 2. (2), 3. (4)

## Page 25: Chapter Three

**Active Reader:** Food chains will vary, but should begin with breakfast and have four energy conversions.

## Page 26: Chapter Three

**Active Reader:** 1. Students should identify at least four types of energy conversions that occur in their energy chain.

**Focus Questions:** 1. any kind, 2. acoustic to mechanical/kinetic

## Page 27: Hands On Science: Discover Energy Conversions

1. Hands should warm up., 2. Mechanical (or kinetic) energy of hand rubbing is being converted to thermal energy (heat)., 3. chemical energy to thermal energy., 4. Answers will vary.

## Page 28: Stop and Think:

1. (1); 2. Energy chain: nuclear energy to thermal energy (steam) to electrical energy to mechanical energy.; 3. Electrical energy from the generator is converted to mechanical energy as the propellers move. In this way potential energy is converted to kinetic energy.

## Page 33: Assessments

**Check Understanding:** 1. (1), 2. (2), 3. Electrical energy is used as a current is passed through the coil., 4. Electrical energy is converted to thermal energy and radiant, or electrocagnetic energy.

## Page 34: Assessments

**Check Understanding:** 5. (1), 6. (4)

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